

Spy Pond Edge Protection and Erosion Control Project

Site Characterization Report

Town of Arlington

December 2016



Introduction

Considerable effort has been expended in recent years to create an ecologically viable, functionally efficient and aesthetically pleasing facility at Spy Pond. During the mid-19th century Spy Pond provided drinking water to the people of Arlington, however, it was abandoned due to increased human activity in the vicinity, including commercial gardening that yielded sediments and nutrients in runoff resulting in extensive weed growth. This situation became prevalent in the early 1900s. Around that time, farms were being converted to lots and roads as the community became increasingly urbanized further affecting water quality that continued to decline with the proliferation of stormwater outfalls. Nevertheless, as a respite from daily activities Spy Pond continued to serve as a focal point for rest and relaxation within the community.

In a 1980-81 Diagnostic Study of Spy Pond by the Massachusetts Division of Water Pollution Control the authors observed that public use and enjoyment of Spy Pond had declined in recent years. The current situation, however, is clear evidence that restoration work in the park over the past decade has been effective and Spy Pond is once again a major focal point for the community. There are, however areas within the park, adjacent to Scannell Field on the east end and adjacent to the Boys and Girls club at the west end where uncontrolled use has created deteriorating conditions that impact water quality and long term sustainability.

Existing Information Sources

Eleven documents were provided by the Town of Arlington Conservation Commission for review to gain familiarity with the significant issues to be dealt with as identified over the past 30 years. These include:

1. **Plan of Route 2 Spy Pond Outlet, prepared for MassDOT** - The reconstructed roadway has 11 outfalls that directly flow into Spy Pond with minimal mitigation measures. Water levels are given based on the 1929 MDPW datum. NAVD 88 datum elevations are provided in brackets. Outlet Spillway elevation 4.17' [3.37'], Historic High water (October 22, 1996) 7.00' [6.20'], typical water elevation (1987-1996) 4.50' [3.70'], Historic Low water (1985-1987) 2.0' +/- [1.2'].
2. **Plans of Route 2 Drainage Repairs and Improvements at Various Locations (Spy Pond), RDA Submission, prepared for MassDOT** - These improvements are unrelated to Spy Pond.
3. **Request for Determination of Applicability prepared by Vanasse Hangen Brustlin, Inc. (VHB), for Route 2 Stormwater Improvements, 2012** - This project has no relationship to the issues under consideration for this project.
4. **Spring Valley Street, Arlington, Concept Plan for a Green Infrastructure Retrofit prepared by Chester Engineers, 2014** - This proposal will be incorporated into this project for consideration.

5. **Spy Pond Bank Stabilization by William Green Associates, 1992** – Solution based on water level of 4.08 as of November 1990. Bank stabilization relies on stone toe with erosion control blanket and ornamental planting on the bank.
6. **Spy Pond Park, 50% Construction Documents prepared by Carol R. Johnson Associates, 2004** - Several areas are identified with various techniques for bank stabilization that are currently not evident on-the-ground with the exception of a stone slope and a stabilized planting area with stacked coir logs along the shore at the end of Linwood Street.
7. **Characterization and Cycling of Phosphorus and Arsenic in Spy Pond prepared for Massachusetts Department of Environmental Management, Lakes and Ponds Program, 2000** - High inputs of phosphorus have caused the pond to become hypereutrophic, resulting in high rates of sedimentation and algal growth.
8. **Review of Recommendations for the Restoration of Spy Pond, Arlington prepared by Hydroanalysis Inc., 1997** - Controls on stormwater that reduce phosphorus reaching the pond are preferable to in-pond controls. Wetland treatment remains a viable alternative for stormwater treatment flowing to Spy Pond.
9. **Feasibility Study of Lake Restoration in Spy Pond, Arlington prepared by the Environmental Design and Planning, Inc., 1982** - Excerpt including the table of contents.
10. **Spy Pond, A Diagnostic Study, 1980-1981 prepared by the Massachusetts Department of Environmental Quality Engineering** - Spy Pond was classified as a eutrophic lake. The major source of nutrients causing the eutrophic conditions was from the stormwater runoff entering the lake.
11. **Spy Pond Stormwater Management Program (s319) prepared by the Town of Arlington, 2007** – Priority pollutants targeted include phosphorous, sediment, suspended solids removal. Installation of leaching catch basin and baffle tanks to reduce phosphorous input into the pond.
12. **Updated Recommendations for Shoreline Restoration prepared by Carol R. Johnson Associates, 2014.**
13. **NOI for Spy Pond Condominium Assn. prepared by New England Environmental, 2010.**

Site Analysis

To account for variable conditions on the ground, the project has been divided into four separate areas as follows:

- Area 1 – Scannell Field
- Area 2 – Spy Pond Park
- Area 3 - Boys & Girls Club
- Area 4 – Spring Valley Street

Please refer on the next page to **Figure 1 - Project Area Locations**.

Figure 1 – Project Location



Prior to developing a full site characterization for each of the four areas, a set of criteria was created to establish the relative stability of the shoreline edge in each area and the need for erosion control. Three classifications with criteria were established as follows:

Table 1. Shoreline Categorization		
Stable	Marginally Stable	Unstable
<ul style="list-style-type: none"> • Vegetated or hardscaped • Uncompacted soil • Controlled human use • Shallower slope • Controlled stormwater runoff • Hard or soft edge 	<ul style="list-style-type: none"> • Scattered loss of vegetation • Compacted soils • Uncontrolled human use 	<ul style="list-style-type: none"> • Loss of stabilizing vegetation • Compacted soil • Uncontrolled human use • Steep slope • Uncontrolled stormwater runoff

Area 1 – Scannell Field (Unstable)

Figure 2 – Area1: Scannell Field



Access and Circulation

The Linwood Street cul-de-sac provides primary access to this area, located on the east side of Spy Pond just south of Spy Pond Park. It is accessible by vehicle, bicycle, or on foot. There is limited two-hour parking in this area so some visitors will likely use the parking lot at the north end of Spy Pond Park and walk.

Circulation on-site is, primarily, foot traffic, either to play or observe a ball game, or to gain access to the pond in a more remote location within the Spy Pond Park. Herein lies the problem since there are no formal pathways that provide access to the water on the pond side of the fence that separates the ball field from the slope to the water.

Existing Vegetation and Habitat Conditions

Numerous old growth trees line the shoreline with extensive root structures providing partial stabilization to portions of the slope and the vertical bank in the vicinity of the water line. In many cases, however, the roots are being undermined by wave action that has eroded soil for depths up to two feet into the slope beneath the roots. Considerable erosion is occurring along vertical banks that are not contained by roots.

There is distributed shrub cover on the slope with root masses to assist in soil stabilization, however, the uncontrolled foot access has created numerous pathways starting along the fence line directly downslope to the water's edge. In these locations vegetation is eliminated and the compacted soil is exposed to erosion exacerbated by uninterrupted sheet flow across the athletic field. Erosion has exposed the roots of many of the old growth trees with ongoing contributions to sediment buildup within the pond.



Photograph 1: Tree with Exposed Roots

The majority of the area is in poor condition with dead and dying trees, exposed roots, unstable banks, extensive areas of eroding soils, and litter that will require a comprehensive approach to stabilization including control of the human activity that is at the root of the problem.



Photograph 2: Erosion with Visible Undercutting



Photograph 3: Erosion and Lack of Vegetation



Photograph 4: Unstable Bank with Exposed Roots and Undercutting

As riparian habitat this area provides cover and food for a variety of small mammals and birds. The deteriorating condition of the slope, however, creates a condition that is less than optimal. Furthermore, the fishery is further degraded by ongoing sedimentation within the water column.

Water Quality

In addition to an actively eroding slope that contributes sediment to the pond, uninterrupted runoff from the athletic field, a likely source of nitrogen and phosphorous fertilization also affects the perennial decline of Spy Pond water quality.

Figure 3– Area1: Scannell Field, Uncontrolled Runoff & Erosion on Slope



Potential Infiltration Areas

As stated above, sheet flow across the athletic field is a likely source of contamination in the pond and, it also contributes to accelerated erosion on the slope. Mitigation is possible by constructing a linear swale along the fence line to stimulate infiltration. The swale could be linked to a bioretention basin in the open area near the cul-de-sac for more effective pollutant removal.

Area 2 – Spy Pond Park (Marginally Stable)

Figure 4 – Area 2: Spy Pond Park



Access and Circulation

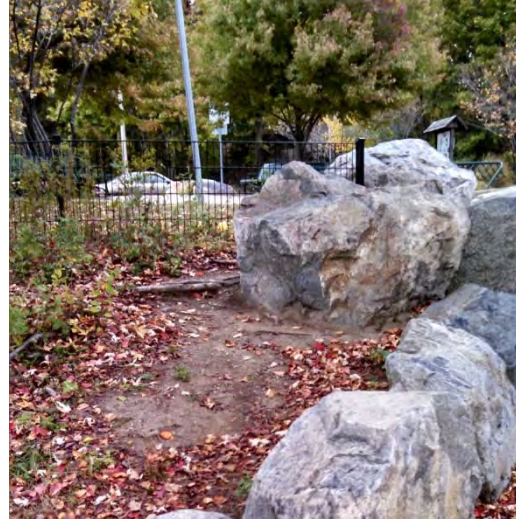
Area 2 is the primary destination for those who are visiting Spy Pond Park. There are four locations for both vehicular and pedestrian access from the nearby residential and commercial areas. Pond Lane provides the primary access to the parking area located at the north end of the park. A secondary access through the parking area is from Wellington Street, further to the west in the vicinity of the Boys and Girls Club. Linwood Street leads to a cul-de-sac on the east side of the park providing access to the park facilities on one side and the Scannell Field on the other. This is primarily a drop-off and pick-up area since the two-hour parking is limited. The Minuteman Commuter Bikeway crosses Linwood Street a short distance uphill from the cul-de-sac providing additional access to Spy Pond Park.

Circulation on site is primarily for pedestrians along designated pathways that provide access to all facilities, including a grassed slope leading to the beach, picnic tables, access points to the water for fishing or relaxation, benches, a children's play area, and a boat ramp for launching small, non-motorized boats, canoes and kayaks. The site improvements to the park were part of the restoration project completed in 2006, see **Figure 5** below.

Figure 5 –Spy Pond Park Restoration



For the most part pedestrians limit themselves to the defined pathways; however, desire lines do exist along the slope to the pond in a few locations between the boat ramp and the beach providing additional access to the water. These informal pathways eliminate stabilizing vegetation that lead to erosion and, consequently, sedimentation in Spy Pond.



Photographs 5 and 6: Foot Paths in Plant Beds with Compacted Soil and Erosion

The area west of the boat ramp on the slope between the water and the retaining wall near the parking lot was not part of the renovations in 2006. This area is essentially removed from the center of activity in the park but it apparently attracts visitation as indicated by the casual pathways and loss of stabilizing vegetation. Dead and dying trees and a poorly maintained stormwater outfall indicate neglect for this somewhat isolated portion of the park.



Photograph 7: 18-inch Stormwater Outfall



Photograph 8: Foot Path along Stone Wall

Existing Vegetation and Habitat Conditions

With a few exceptions, on site vegetation appears to be healthy and well maintained. Outliers include the areas where uncontrolled pathways eliminate the plant growth that provides soil stabilization, particularly west of the boat ramp. Also, along the immediate shoreline, in a few cases where there is a

slight escarpment with no stabilizing tree roots, wave action has eliminated the stabilizing vegetation. There were also a couple of areas where the exposed tree roots along the bank are being undercut by wave action. The line between turf and the north beach is poorly defined and requires some material presence to clearly articulate the boundary.



Photograph 9: Eroded Pond Edge



Photograph 10: Exposed Tree Roots Being Undercut

A well-defined tree and shrub layer on the slope up to the adjacent bikeway provides cover and food for both small mammals and birds. Shrubs and trees along the shoreline provide additional cover. Spy Pond itself can provide some warm water fish habitat although as a water body classified as hypereutrophic it has limitations. The accompanying excessive plant growth, occasional algal blooms, low dissolved oxygen content, low transparency, etc. limit species diversity and, consequently, sport fishing opportunities.

Water Quality and Water Level Management

The total watershed area draining to Spy Pond is 964 acres. The entire watershed with one small exception at Menotomy Park drains through 43 separate outfalls into Spy Pond (Existing Information Source #10, page 2). High inputs of phosphorous have caused the pond to become hypereutrophic. Stormwater runoff and dry weather base flow from a very urban area are the primary contributors to the problem. In addition, there are substantial amounts of both phosphorous and arsenic in the upper 10 to 20 centimeters of the sediments that includes past agricultural use and runoff to the pond. Transport of the sediments into the water column occurs during spring and fall turnover; however, phosphorous inputs in stormwater runoff appear to be as much as 3 to 6 times higher than sediment inputs.

Water level management can be an effective tool for managing water quality. Winter drawdown of the lake surface has at least two beneficial outcomes, controlling macrophytes and reducing shoreline erosion. Lowering the water level by at least three feet in winter exposes shallow aquatic plants to drying and freezing. Plants most affected are Eurasian watermilfoil (*Myriophyllum spicatum*) and Coontail (*Ceratophyllum demersum*). In addition, bank erosion can be reduced by removing accelerated wave action from winter storms and ice buildup from the immediate shoreline (Existing information source #8, page 2).

Area 3 – Boys & Girls Club (Unstable)

Figure 6 – Area 3: Boys & Girls Club



Access and Circulation

Wellington Street is the primary access to this area, although it can be reached via the Pond Lane Extension that links to the Spy Pond Park parking area. There are spaces for 28 cars in the area but this is primarily to serve the adjacent Boys and Girls Club. Abutting the parking area is a grassed strip of land above the steep slope down to Spy Pond that is used for snow storage in the winter.

Because this area is relatively isolated from the rest of Spy Pond Park, it is not as heavily used. There is no formal access to the pond and so casual pathways down and across the vertical slope have evolved in several locations over time. All of these informal access areas are eroding and contributing sediment to the pond.

Existing Vegetation, Habitat, and Water Quality Conditions

Vegetation in this location has not been disturbed to the extent that it has adjacent to Scannell Field since primary access is along the top of the slope in a grassed area. There are, however, nine separate pathways down the steep slope to another pathway at mid slope and, occasionally, along the water's edge. All nine have compacted, eroding soil that is deposited in the pond. As a relatively isolated area it

serves to provide habitat for small animals and birds, however, sediment from the uncontrolled pathways contributes negatively to the aquatic habitat. Any and all sediment that enters the water of Spy Pond continues to degrade the water quality.



Photograph 11: Steep Eroded Slope



Photograph 12: Numerous Foot Paths

Stormwater from the adjacent pavement in Wellington Street and Pond Lane Extension drains into a catch basin at the curb next to this segment of parkland. From there it is piped through a manhole directly into Spy Pond at the base of the slope. The 12-inch outfall is partially filled with sediment and water. The outfall is ill-defined due to the lack of an endwall and the surrounding vegetation that grown in obscuring it from view.



Photograph 13: Obscured 12-inch Stormwater Outfall

Area 4 – Spring Valley Street (Unstable)

Figure 7 – Area 4: Spring Valley Street



Circulation and Access

This component of the project was part of a conceptual green infrastructure retrofit developed by Chester Engineers in 2014 in conjunction with a stormwater grant sponsored by Mystic River Watershed Association (MyWRA) and implemented through Arlington's Public Works Department. The concept was designed to divert stormwater runoff from the Spring Valley Street into a cascading bioretention channel leading to a small treatment wetland and from there into Spy Pond. It is situated at the end of Spring Valley Street, accessible by vehicle or on foot. The area currently serves as a small boat launch facility for surrounding neighbors.



Photograph 14: Uncontrolled Stormwater Runoff



Photograph 15: Small Boat Launch Facility, Lower End of Spring Valley Street

Existing Vegetation, Habitat, and Water Quality Conditions

A recent rainfall event that produced high energy sheet flow across the paved boat launch area at the end Spring Valley Road undermined and overturned a 30-inch diameter poplar tree that served to stabilize the bank adjacent to Spy Pond. The upturned, root ball, approximately eight feet in diameter has created a large, eroding crater in the slope at the water's edge. The fallen tree extends out into the pond for approximately 80 feet, supported by broken limbs.



Photograph 16: Eroded Slope near Stormwater Outfall



Photograph 17: Eroded Slope at the Uprooted Tree



Photograph 18: Uprooted Tree

In addition to the fallen tree, there are a few small trees on the periphery of the site, however, extensive use as a boat launch facility has eliminated understory and ground plane vegetation with the exception of some scattered groundcover. The portion of the bank to the pond that is not affected by the overturned tree is vegetated, and relatively stable. Habitat value for upland species is minimal and sediment from the exposed and eroding soil negatively impacts both water quality and aquatic habitat.

Summary of Existing Shoreline Conditions

Existing Shoreline Categorizations			
Area 1: Scannell Field	Area 2: Spy Pond Park	Area 3: Boys & Girls Club	Area 4: Spring Valley Street
Unstable <ul style="list-style-type: none"> • Loss of stabilizing vegetation • Compacted soils • Uncontrolled human use • Steep slope • Uncontrolled stormwater runoff 	Marginally Stable <ul style="list-style-type: none"> • Scattered loss of vegetation • Compacted Soils • Uncontrolled human use 	Unstable <ul style="list-style-type: none"> • Loss of stabilizing vegetation • Compacted soil • Uncontrolled human use • Steep slope 	Unstable <ul style="list-style-type: none"> • Loss of stabilization • Steep slope • Uncontrolled stormwater runoff • Human use